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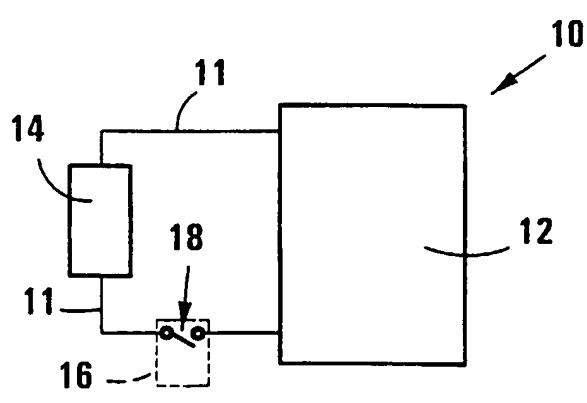

(57) **Abstract:** The invention provides a telemetry device (10) which includes at least one passive RFID transponder or tag (12), and at least one passive sensor (16) for sensing a monitored condition and modifying the response of the RFID transponder to an interrogation signal dependent on the monitored condition. The invention extends to a method of indicating at least one monitored condition by means of telemetry. The method includes sensing the monitored condition with at least one passive sensor associated with at least one passive RFID transponder or tag, with the at least one passive sensor and dependent upon the monitored condition, modifying a response of the at least one RFID transponder to a potential interrogation signal, and interrogating the at least one RFID transponder with an interrogation signal to obtain the response, if any, of the at least one RFID transponder.

WO 02/073523 A1

TELEMETRY

THIS INVENTION relates to telemetry. In particular, the invention relates to a telemetry device and to a method of indicating at least one monitored condition by means of telemetry.

The Applicant is aware of identification systems in which transponders are activated by an interrogation signal and then transmit reply signals, usually containing identification data, to a receiver, which typically forms part of the interrogator. In passive electronic ID systems the radio frequency identification (RFID) transponder or "tag" is not powered by a battery or other means. Instead, the interrogation signal also acts as an energy beam used to power the RFID transponder. A small part of this energy is reflected back to the interrogator modulated with an ID code (so-called "back scatter" technique). The Applicant is also aware of identification systems in which a multiplicity of RFID transponders can be read simultaneously. In this case the transponders employ an anti-collision protocol to allow a reader to receive separate ID codes from each of the transponders.

It is often required to measure environmental and process variables and to communicate these measurements to a remote location or to generate an alarm when these variables exceed (go above or below) pre-set threshold values. Often the requirement occurs in hazardous or extreme environments, or inaccessible locations. Examples are temperature sensing inside a nuclear reactor or pressure sensing inside a tyre. This remote sensing and communication of the measurement result is commonly known as telemetry.

In some cases it is important that the fact that an alarm condition was triggered must still be evident at a later stage. In this case trip switches of various

kinds are typically employed. Examples of these are G-force switches that trip or break when an object is subjected to excessive accelerations or vibrations. The fact that the object had been mishandled remains evident for later inspection.

It is often also important to be able to identify and locate the items on which alarms were raised quickly and efficiently. An example of such a case is a freezer packed with frozen fish - when the freezer fails all the fish are dumped, but most often only part of the fish has reached the critical maximum temperature. The still frozen fish needs to be identified fast to prevent further losses.

The Applicant is aware of RF Identification systems in which an A/D converter is integrated on or combined with a RFID chip. Because of the high power consumption of the sense element or it's a/D converter, such arrangements are conventionally powered, e.g. with a battery or other means.

A passive tag typically receives its energy from an energy beam transmitted by the interrogator or reader. The energy density in such a beam falls off as the square of the distance. In order to achieve longer reading ranges it is important that the circuitry (RFID chip and sense element) consumes as little power as possible. While it is technically feasible to power a sense element from the RFID chip, i.e. also from the energy transmitted by the interrogator, this would typically reduce the reading range. For various reasons (size, cost, extreme environment, movement, maintainability, reduced reading range, etc.), it might not be desirable or practical to supply power to such a sensing element.

According to one aspect of the invention, there is provided a telemetry device which includes

at least one passive RFID transponder or tag; and

at least one passive sensor for sensing a monitored condition and modifying the response of the RFID transponder to an interrogation signal dependent on the monitored condition.

As will be appreciated, the telemetry device of the invention is thus a passive telemetry device requiring no internal power source. Furthermore, the at least one sensor is not powered by the RFID transponder when the transponder is being interrogated with an interrogation signal, thus promoting a long reading range for the RFID transponder.

Typically, the or each RFID transponder is a long range, multi-read RFID transponder.

The sensor may be a digital sensor, i.e. a sensor capable of sensing at any time one of two conditions only. Thus, the at least one sensor may include a switch, configured to change condition in response to a notifiable change in the monitored condition e.g. when a monitored condition has reached a preselected value or state or has deviated a preselected degree from a particular value or state. The switch may be a continuous switch, i.e. the switch may be able to change condition repeatedly as a monitored condition changes. Instead, the switch may be a single use switch which changes condition permanently when a monitored condition has reached a preselected value or state. Yet a further possibility is for the switch to be a resettable switch, allowing re-use of the telemetry device of the invention. Examples of a sensor comprising a continuous switch is a bi-metal temperature sensor that opens and closes a contact as temperature fluctuates, and a CdS resistor for light measurement. Examples of a sensor comprising single use switches are a trip sensor and a G-force sensor that changes condition permanently when the monitored condition reaches or exceeds a threshold value. An example of a sensor comprising a resettable switch is a resettable trip sensor.

Instead, the sensor may be arranged proportionally to modify the response of the RFID transponder to an interrogation signal in response to the magnitude of the change in the monitored condition. For example, an analogue sensor such as a variable capacitor, resistor or inductor may be used. The analogue sensor can, for example, modify a rate of data transmission, thereby providing an analogue

measure of the monitored condition. A receiver may then detect the change in data rate and decode it to provide an analogue indication of the monitored condition.

The sensor may be arranged to connect or disconnect or change the configuration of a component, e.g. an antenna, coil, supply rail, or the like of the RFID transponder in response to a notifiable change in the monitored condition. As will be appreciated, this arrangement allows the RFID transponder to be read only when the component, e.g. antenna, coil or the like is connected to the RFID transponder, or changes the response of the RFID transponder to an interrogation signal, providing an indication of whether or not the monitored condition has reached a preselected value or state.

Instead, the sensor may be arranged to provide a logic input to the RFID transponder to modify the operation of the RFID transponder in response to a notifiable change in the monitored condition. For example, the sensor may modify the ID code of the RFID transponder by adding or removing one or more bits to or from the ID code when the sensor senses that the monitored condition has reached the preselected value or state.

The telemetry device may include a plurality of passive sensors for sensing a plurality of monitored conditions, each one of the sensors being arranged to modify the response of the RFID transponder to an interrogation signal when the sensor detects a notifiable change in the condition monitored by the sensor. An example of such a telemetry device is a telemetry device comprising a RFID transponder and sensors for sensing elapsed time, temperature, G-force and vibrations, the sensors being of the kind comprising resettable switches. The sensors may then be arranged in series to show a single "off" alarm condition or the sensors may be arranged in parallel to show a single "on" alarm condition.

Instead, or in addition, the telemetry device may include a plurality of passive RFID transponders and a plurality of passive sensors, the response of at least some of the RFID transponders to an interrogation signal being modifiable by at least

one sensor associated with each of these transponders. The response of at least one transponder may be modifiable by a plurality of the sensors.

The sensor may be mechanical or electronic in nature, and may be discrete, micro-machined or integrated on a chip of the RFID transponder.

The invention extends to a passive RFID transponder or tag which includes a passive sensor responsive to a sensed condition and arranged to modify a response of the transponder or tag to an interrogation signal dependent on the sensed condition.

According to another aspect of the invention, there is provided a method of indicating at least one monitored condition by means of telemetry, the method including

sensing the monitored condition with at least one passive sensor associated with at least one passive RFID transponder or tag;

with the at least one passive sensor and dependent upon the monitored condition, modifying a response of the at least one RFID transponder to a potential interrogation signal; and

interrogating the at least one RFID transponder with an interrogation signal to obtain the response, if any, of the at least one RFID transponder.

The or each RFID transponder and the or each passive sensor may be as hereinbefore described.

Modifying a response of the RFID transponder to a potential interrogation signal may include enabling a disabled transponder to respond to an interrogation signal, or disabling an able transponder to prevent the transponder from responding to an interrogation signal. Modifying a response of the RFID transponder to a potential interrogation signal may thus include connecting or disconnecting or changing the configuration of a component, e.g. an antenna, coil, supply rail, or the like of the RFID transponder with the passive sensor when the monitored condition has reached a

preselected value or state. Thus, as will be appreciated, when the antenna, coil, supply rail, or the like of the RFID transponder is disconnected, the response of the RFID transponder to an interrogation signal will be one of no response.

Instead, modifying a response of the RFID transponder to a potential interrogation signal may include modifying the ID code of the RFID transponder with the passive sensor in response to a notifiable change in the monitored condition.

Modifying a response of the RFID transponder to a potential interrogation signal may further include modifying a data transmission rate of the RFID transponder. The data transmission rate may be modified proportionally to the magnitude of the change in the monitored condition.

The method may include indicating a plurality of different monitored conditions by sensing a plurality of different kinds of passive sensors, each passive RFID transponder being associated with one or more passive sensors.

The method may include sensing the same monitored condition with a plurality of similar sensors associated with a plurality of passive RFID transponders, each sensor being set to modify the response of the RFID transponder associated with the sensor to a potential interrogation signal at a different preselected condition or change in condition. The method may then include interrogating all the RFID transponders with the interrogation signal to obtain the responses, if any, of all the RFID transponders. As will be appreciated, in this fashion a measurement of the monitored condition with a preselected degree of accuracy can be obtained.

The invention extends to a method of modifying a response of a passive RFID transponder to an interrogation signal thereby to communicate a change in a sensed condition, the method including changing the configuration of the transponder by means of a passive sensor located in circuitry of the transponder and responsive to the sensed condition.

Changing the configuration of the transponder by means of the passive sensor may include enabling a disabled transponder to respond to an interrogation signal or disabling an able transponder to prevent the transponder from responding to an interrogation signal. Changing the configuration of the transponder by means of the passive sensor may be effected by modifying an antenna, coil, or the like, modifying the ID code of the RFID transponder, modifying the connection of a supply rail, or activating a reset pin of the RFID transponder, with a switch forming part of the passive sensor.

Instead, changing the configuration of the transponder by means of the passive sensor may include modifying a data transmission rate of the transponder.

The invention also extends to a method of modifying a response of a passive RFID transponder to an interrogation signal, the method including connecting or disconnecting or changing the configuration of a component of the RFID transponder with a passive sensor which includes a switch changing condition in response to a notifiable change in a sensed condition or state and which is connected to the component.

The invention also extends to a method of modifying a response of a passive RFID transponder with a logic input to an interrogation signal, the method including modifying the ID code of the RFID transponder with a passive sensor connected to the logic input of the RFID transponder.

The passive sensor may include a switch changing condition in response to a notifiable change in a sensed condition or state.

The invention further extends to a method of modifying a response of a passive RFID transponder to an interrogation signal, the method including modifying a data transmission rate of an ID code of the transponder with a passive sensor.

The passive sensor may be connected to a logic input of the RFID transponder.

Modifying the data transmission rate may include switching between fixed data transmission rates. Instead, modifying the data transmission rate may include varying the data transmission rate over a range of data transmission rates, which may be a continuous range.

The invention will now be described, by way of example, with reference to the following diagrammatic drawings in which

Figure 1 shows one embodiment of a telemetry device in accordance with the invention;

Figure 2 shows another embodiment of a telemetry device in accordance with the invention;

Figure 3 shows a further embodiment of a telemetry device in accordance with the invention;

Figure 4 shows yet another embodiment of a telemetry device in accordance with the invention;

Figure 5 shows yet a further embodiment of a telemetry device in accordance with the invention; and

Figure 6 shows still a further embodiment of a telemetry device in accordance with the invention.

Referring to Figure 1 of the drawings, reference numeral 10 generally indicates a telemetry device in accordance with the invention. The device 10 includes a passive RFID transponder or tag comprising a RFID chip 12 and an antenna 14 connected electrically by means of leads 11 to the chip 12. A sensor 16, comprising a switch 18 is associated with the chip 12 and antenna 14 such that the switch 18 is connected in series between the antenna 14 and the chip 12.

The sensor 16 can be any passive sensor for sensing any monitored condition and which incorporates a switch (such as the switch 18) which changes its

condition when the monitored condition has reached a preselected value or state. Typical examples of the sensor 16 are a bi-metal strip for temperature sensing, a level sensor with a float switch, a pressure sensor with a diaphragm activating a switch, a CdS resistor for light measurement, a tripwire for sensing movement and a glass G-force switch.

In use, when the sensor 16 has sensed a change in the monitored condition to the extent that the switch 18 changes position from open to closed or closed to open, the antenna 14 is connected or disconnected, as the case may be, from the chip 12. When the antenna 14 is disconnected from the chip 12, the RFID transponder will provide no response to an interrogation signal. When the antenna 14 is connected to the chip 12, the RFID transponder will provide a response to an interrogation signal. Thus, based on the presence or absence of a response from the RFID transponder, one can deduce the state of the switch 18 and accordingly the condition sensed by the sensor 16.

Referring to Figure 2 of the drawings, reference numeral 20 generally indicates another embodiment of a telemetry device in accordance with the invention. The telemetry device 20 is similar to the telemetry device 10 and the same reference numerals are thus used to indicate the same or similar parts or features.

The only difference between the telemetry device 20 and the telemetry device 10 is the arrangement of the switch 18 of the sensor 16 relative to the chip 12 and the antenna 14. In the device 20, the switch 18, when closed, shorts out the antenna 14, thereby disabling the RFID transponder. However, the functioning of the telemetry device 20 is identical to the functioning of the telemetry device 10.

Referring to Figure 3 of the drawings, reference numeral 30 generally indicates a further embodiment of a telemetry device in accordance with the invention. The telemetry device 30 can be used to distinguish between eight temperature ranges.

The telemetry device 30 includes three RFID chips 12.1, 12.2, 12.3, three antennas 14.1, 14.2 and 14.3, each associated with one of the RFID chips 12.1, 12.2, 12.3, and four temperature sensors 16.1, 16.2, 16.3 and 16.4. The sensors 16.1, 16.2 and 16.3 and 16.4 are connected in series between the antennas 14.1, 14.2 and 14.3 and the chips 12.1, 12.2 and 12.3 respectively.

The RFID chips 12.1, 12.2 and 12.3 are multi-read passive radio frequency (RF or inductively coupled) transponder chips. The switch 18.1 is a single pole, single throw switch which, in the embodiment depicted in the drawings, is closed above a selected temperature of 50 °C. Switches 18.2, 18.3 and 18.4 are single pole double throw switches. For the switch 18.2, a common contact is connected to one pole below a preselected temperature of 20 °C and connected to the other pole above a preselected temperature of 60 °C. For the switch 18.3 a common contact is connected to one pole below a preselected temperature of 50 °C and connected to the other pole above a preselected temperature of 70 °C. For the switch 18.4, a common contact is connected to one pole below a preselected temperature of 10 °C and connected to the other pole above a preselected temperature of 30 °C.

The following Table 1 indicates the status of the telemetry device 30 at different sensed temperatures. In the table, "pole 1" refers to the low temperature pole of a double throw switch and "pole 2" refers to the high temperature pole of a double throw switch.

Table 1 : Telemetry device 30 status at different temperatures

Temperature range	Switch positions	Enabled tags
Below 10 °C	18.1 open 18.2 to pole 1 18.3 to pole 1 18.4 to pole 1	12.2, 12.3
10 to 20 °C	18.1 open 18.2 to pole 1 18.3 to pole 1 18.4 open	12.2

20 to 30 °C	18.1 open 18.2 open 18.3 to pole 1 18.4 open	none
30 to 40 °C	18.1 open 18.2 open 18.3 to pole 1 18.4 to pole 2	12.3
40 to 50 °C	18.1 closed 18.2 open 18.3 to pole 1 18.4 to pole 2	12.1, 12.3
50 to 60 °C	18.1 closed 18.2 open 18.5 open 18.6 to pole 2	12.1
60 to 70 °C	18.1 closed 18.2 to pole 2 18.3 open 18.4 to pole 2	12.1, 12.2
Above 70 °C	18.1 closed 18.2 to pole 2 18.3 to pole 2 18.4 to pole 2	12.1, 12.2, 12.3

It is thus clear that different combinations of RFID transponders will be activated in the different temperature ranges. A RFID transponder or tag interrogator will therefore be able to distinguish between the temperature ranges by noting which RFID tags are active and thus makes use of a 3-bit code to convey temperature ranges. As will be appreciated, the telemetry device 30 is only one possible example of a combination of passive sensors to provide a reading of a monitored condition over a range of preselected values.

It should be noted that although the switches of the sensors in the Figures 1, 2 and 3 are shown in series or parallel with an antenna, this may not be practical, as it is possible that the switch could affect the tuning of the antenna, especially at higher frequencies. This problem can easily be overcome by placing a switch in parallel or series with a supply rail of a RFID chip, or connecting the switch to a reset pin of the RFID chip.

Referring to Figures 4, 5 and 6 of the drawings, reference numerals 40, 50 and 60 respectively generally indicate further embodiments of a telemetry device in accordance with the invention. The telemetry devices 40, 50, 60 are similar to the telemetry devices 10, 20, 30 and unless otherwise indicated, the same reference numerals are used to indicate the same or similar parts or features.

In the telemetry device 40, an analogue sensor 19 in the form of a variable resistor is used instead of the digital sensor 16 used in the telemetry devices 10, 20, 30. The analogue sensor 19 is connected to separate logic inputs of the chip 12 of the telemetry device 40.

In use, the sensor 19 monitors a condition, e.g. temperature or strain. As the monitored condition changes so does the value of the variable resistor, changing the data transmission rate of the chip 12 accordingly via the inputs to the chip 12. In response to an interrogation signal from a receiver the telemetry device 40 will transmit its ID code at a data rate proportional to the measured condition. The receiver can measure the incoming data rate and from that determine the measured condition. As will be appreciated, in this embodiment of the invention the RFID transponder is never disabled and will always reply to an interrogation signal received by it.

Referring to Figure 5 of the drawings, the telemetry device 50, although similar to the telemetry device 40, is differentiated by the fact that the analogue sensor 19 of the telemetry device 40 is replaced by a digital sensor 16 comprising a switch 18. The switch 18 is connected to a logic input of the chip 12 and controls the data transmission rate, selecting between two predetermined frequencies, depending on the position of the switch 18.

In use, when the sensor 16 of the telemetry device 50 has sensed a change in a monitored condition to the extent that the switch 18 changes from open to closed or closed to open, the logic input to the chip 12 changes state and the

corresponding data transmission frequency is selected when replying to an interrogation signal from a receiver.

Referring to Figure 6 of the drawings, the telemetry device 60 is similar to the telemetry device 50 and to the telemetry device 30. In fact, the application of the telemetry device 60 is the same or similar to the application of the telemetry device 30. The sensors 16.1, 16.2, 16.3 and 16.4, respectively comprising switches 18.1, 18.2, 18.3 and 18.4 are however all connected to the logic inputs of a single chip 12. Thus, unlike the telemetry device 30 which uses a 3-bit code to convey temperature readings by means of the presence or absence of three identification responses from three transponders, the telemetry device 60 conveys the temperature reading directly in the ID code transmitted by the single transponder, or alternatively by means of selecting between eight different data transmission rates.

It is an advantage of the invention, as illustrated, that it provides a passive telemetry device requiring no internal power source. These devices can be used in hazardous or extreme environments or inaccessible locations. Advantageously, the telemetry devices of the invention, as illustrated, typically has a long reading range and depending on the configuration of the telemetry device, can generate an alarm condition, which may still be evident at a later stage, or can measure and communicate multi-valued measurements, either as discrete values or conditions or discrete ranges, or as analogue values over a continuous range.

CLAIMS:

1. A telemetry device which includes

at least one passive RFID transponder or tag; and

at least one passive sensor for sensing a monitored condition and modifying the response of the RFID transponder to an interrogation signal dependent on the monitored condition.

2. A telemetry device as claimed in claim 1, in which the or each RFID transponder is a long range, multi-read RFID transponder.

3. A telemetry device as claimed in claim 1 or claim 2, in which the at least one sensor includes a switch, configured to change condition in response to a notifiable change in the monitored condition.

4. A telemetry device as claimed in claim 1 or claim 2, in which the sensor is arranged proportionally to modify the response of the RFID transponder to an interrogation signal in response to the magnitude of a change in the monitored condition.

5. A telemetry device as claimed in any one of claims 1 to 4 inclusive, in which the sensor is arranged to provide a logic input to the RFID transponder to modify the operation of the RFID transponder in response to a notifiable change in the monitored condition.

6. A telemetry device as claimed in claims 1 to 3 inclusive, in which the sensor is arranged to connect or disconnect or change the configuration of a component of the RFID transponder in response to a notifiable change in the monitored condition.

7. A telemetry device as claimed in any one of the preceding claims, which includes a plurality of passive sensors for sensing a plurality of monitored conditions,

each one of the sensors being arranged to modify the response of the RFID transponder to an interrogation signal when the sensor detects a notifiable change in the condition monitored by the sensor.

8. A telemetry device as claimed in any one of claims 1 to 6 inclusive, which includes a plurality of passive RFID transponders and a plurality of passive sensors, the response of at least some of the RFID transponders to an interrogation signal being modifiable by at least one sensor associated with each of these transponders, and the response of at least one transponder being modifiable by a plurality of the sensors.

9. A passive RFID transponder or tag which includes a passive sensor responsive to a sensed condition and arranged to modify a response of the transponder or tag to an interrogation signal dependent on the sensed condition.

10. A method of indicating at least one monitored condition by means of telemetry, the method including

sensing the monitored condition with at least one passive sensor associated with at least one passive RFID transponder or tag;

with the at least one passive sensor and dependent upon the monitored condition, modifying a response of the at least one RFID transponder to a potential interrogation signal; and

interrogating the at least one RFID transponder with an interrogation signal to obtain the response, if any, of the at least one RFID transponder.

11. A method as claimed in claim 10, in which modifying a response of the RFID transponder to a potential interrogation signal includes enabling a disabled transponder to respond to an interrogation signal, or disabling an able transponder to prevent the transponder from responding to an interrogation signal.

12. A method as claimed in claim 10, in which modifying a response of the RFID transponder to a potential interrogation signal includes modifying the ID code of

the RFID transponder with the passive sensor in response to a notifiable change in the monitored condition.

13. A method as claimed in claim 10, in which modifying a response of the RFID transponder to a potential interrogation signal includes modifying a data transmission rate of the RFID transponder.

14. A method as claimed in claim 13, in which the data transmission rate is modified proportionally to the magnitude of the change in the monitored condition.

15. A method as claimed in any one of claims 10 to 12 inclusive, in which the method includes sensing the same monitored condition with a plurality of similar sensors associated with a plurality of passive RFID transponders, each sensor being set to modify the response of the RFID transponder associated with the sensor to a potential interrogation signal at a different preselected condition or change in condition, and the method including interrogating all the RFID transponders with the interrogation signal to obtain the responses, if any, of all the RFID transponders.

16. A method of modifying a response of a passive RFID transponder to an interrogation signal thereby to communicate a change in a sensed condition, the method including changing the configuration of the transponder by means of a passive sensor located in circuitry of the transponder and responsive to the sensed condition.

17. A method as claimed in claim 16, in which changing the configuration of the transponder by means of the passive sensor includes enabling a disabled transponder to respond to an interrogation signal or disabling an able transponder to prevent the transponder from responding to an interrogation signal.

18. A method as claimed in claim 16, in which changing the configuration of the transponder by means of the passive sensor includes modifying a data transmission rate of the transponder.

19. A method of modifying a response of a passive RFID transponder to an interrogation signal, the method including connecting or disconnecting or changing the configuration of a component of the RFID transponder with a passive sensor which includes a switch changing condition in response to a notifiable change in a sensed condition or state and which is connected to the component.

20. A method of modifying a response of a passive RFID transponder with a logic input to an interrogation signal, the method including modifying the ID code of the RFID transponder with a passive sensor connected to the logic input of the RFID transponder.

21. A method as claimed in claim 20, in which the passive sensor includes a switch changing condition in response to a notifiable change in a sensed condition or state.

22. A method of modifying a response of a passive RFID transponder to an interrogation signal, the method including modifying a data transmission rate of an ID code of the transponder with a passive sensor.

23. A method as claimed in claim 22, in which the passive sensor is connected to a logic input of the RFID transponder.

24. A telemetry device as claimed in claim 1, substantially as herein described and illustrated.

25. A transponder as claimed in claim 9, substantially as herein described and illustrated.

26. A method of indicating at least one monitored condition as claimed in claim 10, substantially as herein described and illustrated.

27. A method of modifying a response of a passive RFID transponder as claimed in claim 16 or claim 19 or claim 20 or claim 22, substantially as herein described and illustrated.

28. A new telemetry device, a new transponder, a new method of indicating a monitored condition, or a new method of modifying a response of a transponder, substantially as herein described.

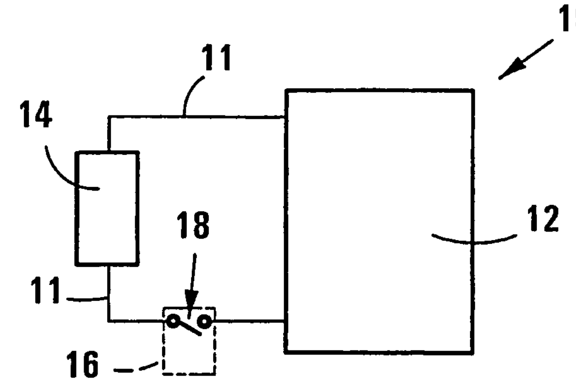

FIG 1

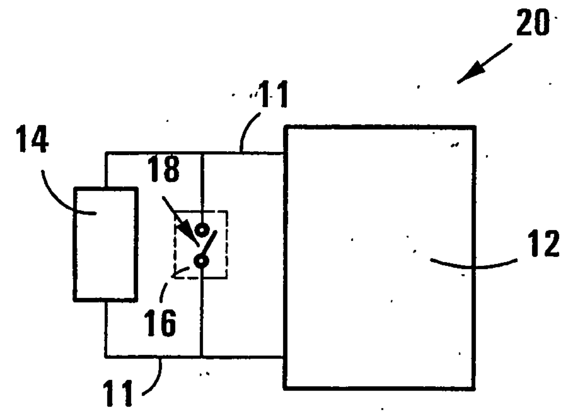

FIG 2

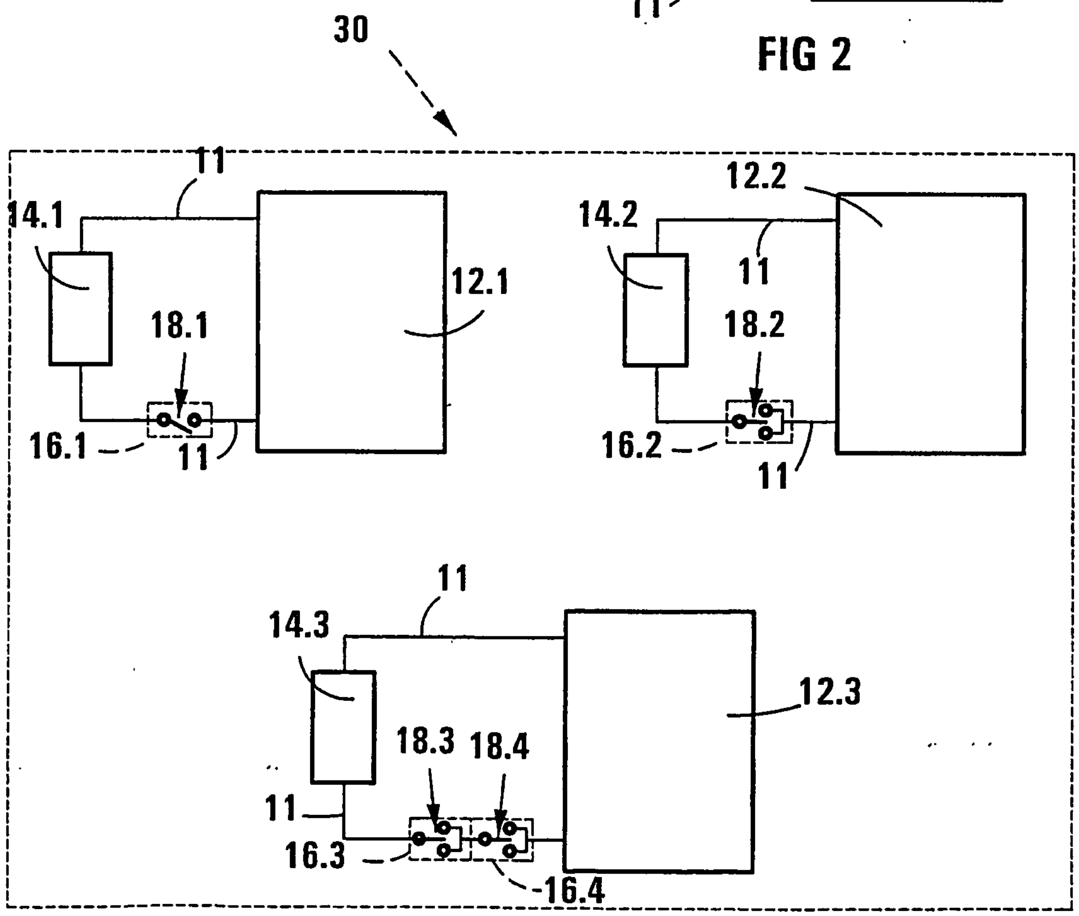

FIG 3

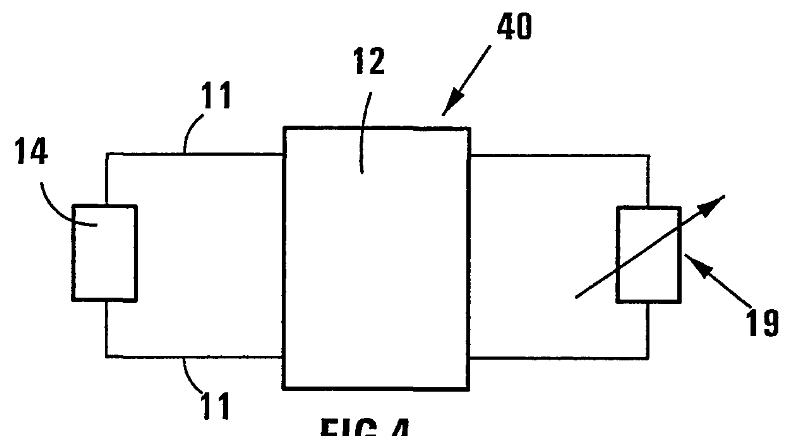

FIG 4

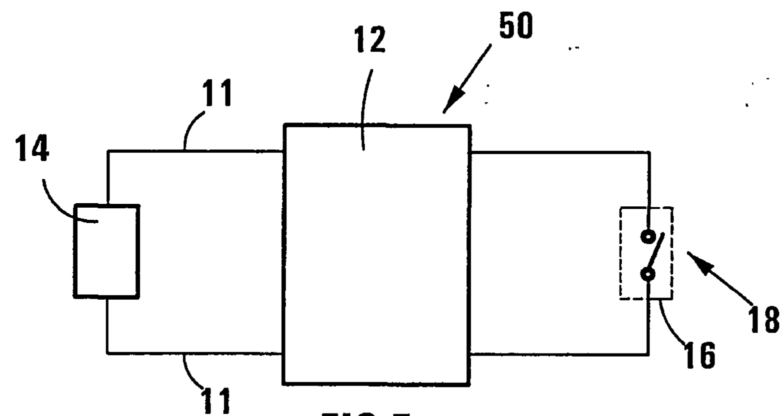

FIG 5

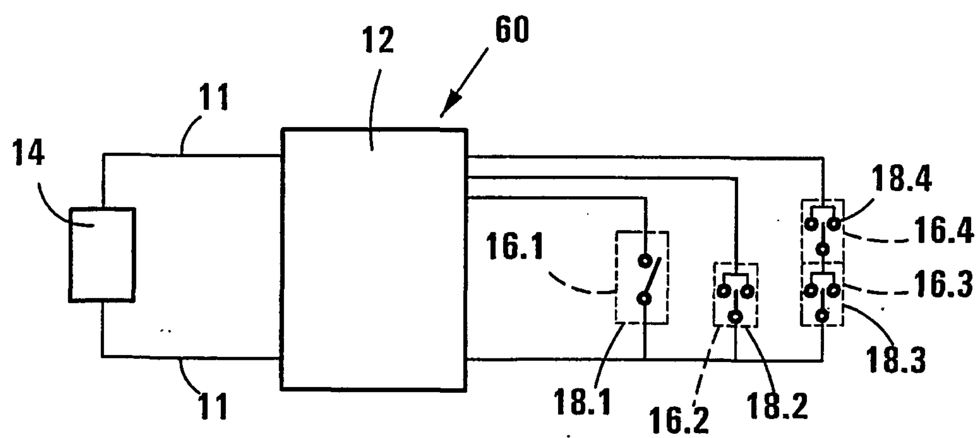

FIG 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 02/00712

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06K19/07 G06K19/073

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ, IBM-TDB, INSPEC, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 94 27117 A (MULTILOP LTD ;VAHRMAN RICHARD (GB)) 24 November 1994 (1994-11-24)	1-7, 10-12, 19-21, 24-28
Y	page 5, paragraph 6 -page 10, paragraph 1; figures 1,3	22,23
Y	GB 2 344 232 A (OTTER CONTROLS LTD) 31 May 2000 (2000-05-31) page 8, line 18 - line 28; claims 1,6-9	22,23
X	US 5 461 385 A (ARMSTRONG WILLIAM E) 24 October 1995 (1995-10-24) the whole document	1-6, 9-12,16, 19-21, 24-28

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
4 July 2002	16/07/2002

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 02/00712

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US 5461385	A	24-10-1995	NONE		